```
MMM         MMM  TTTTTTTTTTTTTTT  HHH         HHH  RRRRRRRRRRRR     TTTTTTTTTTTTTTT  LLL
MMM         MMM  TTTTTTTTTTTTTTT  HHH         HHH  RRRRRRRRRRRR     TTTTTTTTTTTTTTT  LLL
MMM         MMM  TTTTTTTTTTTTTTT  HHH         HHH  RRRRRRRRRRRR     TTTTTTTTTTTTTTT  LLL
MMMMMM   MMMMMM        TTT        HHH         HHH  RRR         RRR        TTT        LLL
MMMMMM   MMMMMM        TTT        HHH         HHH  RRR         RRR        TTT        LLL
MMMMMM   MMMMMM        TTT        HHH         HHH  RRR         RRR        TTT        LLL
MMM   MMM   MMM        TTT        HHH         HHH  RRR         RRR        TTT        LLL
MMM   MMM   MMM        TTT        HHH         HHH  RRR         RRR        TTT        LLL
MMM   MMM   MMM        TTT        HHH         HHH  RRR         RRR        TTT        LLL
MMM         MMM        TTT        HHHHHHHHHHHHHHH  RRRRRRRRRRRR           TTT        LLL
MMM         MMM        TTT        HHHHHHHHHHHHHHH  RRRRRRRRRRRR           TTT        LLL
MMM         MMM        TTT        HHHHHHHHHHHHHHH  RRRRRRRRRRRR           TTT        LLL
MMM         MMM        TTT        HHH         HHH  RRR   RRR              TTT        LLL
MMM         MMM        TTT        HHH         HHH  RRR   RRR              TTT        LLL
MMM         MMM        TTT        HHH         HHH  RRR   RRR              TTT        LLL
MMM         MMM        TTT        HHH         HHH  RRR      RRR           TTT        LLL
MMM         MMM        TTT        HHH         HHH  RRR      RRR           TTT        LLL
MMM         MMM        TTT        HHH         HHH  RRR      RRR           TTT        LLL
MMM         MMM        TTT        HHH         HHH  RRR         RRR        TTT        LLLLLLLLLLLLLLL
MMM         MMM        TTT        HHH         HHH  RRR         RRR        TTT        LLLLLLLLLLLLLLL
MMM         MMM        TTT        HHH         HHH  RRR         RRR        TTT        LLLLLLLLLLLLLLL
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**FILE**ID**MTHCDSINC




          MM      MM  TTTTTTTTTT  HH      HH    CCCCCCCC  DDDDDDDD      SSSSSSSS    IIIIII    NN      NN    CCCCCCCC
          MM      MM  TTTTTTTTTT  HH      HH    CCCCCCCC  DDDDDDDD      SSSSSSSS    IIIIII    NN      NN    CCCCCCCC
          MMMM  MMMM      TT      HH      HH  CC          DD      DD  SS              II      NN      NN  CC
          MMMM  MMMM      TT      HH      HH  CC          DD      DD  SS              II      NN      NN  CC
          MM  MM  MM      TT      HH      HH  CC          DD      DD  SS              II      NNNN    NN  CC
          MM  MM  MM      TT      HH      HH  CC          DD      DD  SS              II      NNNN    NN  CC
          MM      MM      TT      HHHHHHHHHH  CC          DD      DD    SSSSSS        II      NN  NN  NN  CC
          MM      MM      TT      HHHHHHHHHH  CC          DD      DD    SSSSSS        II      NN  NN  NN  CC
          MM      MM      TT      HH      HH  CC          DD      DD          SS      II      NN    NNNN  CC
          MM      MM      TT      HH      HH  CC          DD      DD          SS      II      NN    NNNN  CC
          MM      MM      TT      HH      HH  CC          DD      DD          SS      II      NN      NN  CC              ....
          MM      MM      TT      HH      HH  CC          DD      DD          SS      II      NN      NN  CC              ....
          MM      MM      TT      HH      HH    CCCCCCCC  DDDDDDDD    SSSSSSSS      IIIIII    NN      NN    CCCCCCCC      ....
          MM      MM      TT      HH      HH    CCCCCCCC  DDDDDDDD    SSSSSSSS      IIIIII    NN      NN    CCCCCCCC      ....


          LL            IIIIII      SSSSSSSS
          LL            IIIIII      SSSSSSSS
          LL              II      SS
          LL              II      SS
          LL              II      SS
          LL              II      SS
          LL              II        SSSSSS
          LL              II        SSSSSS
          LL              II              SS
          LL              II              SS
          LL              II              SS
          LL              II              SS
          LLLLLLLLLL    IIIIII    SSSSSSSS
          LLLLLLLLLL    IIIIII    SSSSSSSS
```

Table of contents

```
    (2)       51        HISTORY          ; Detailed Current Edit History
    (3)       59        DECLARATIONS
    (4)       87        MTH$CDSIN - D COMPLEX*16 SINE
    (5)      136        MTH$CDCOS - D COMPLEX*16 Cosine
    (6)      187        WORKER - do all the work
```

```
0000            .TITLE  MTH$CDSINCOS    D COMPLEX*16 Sine and Cosine
0000            .IDENT  /1-002/         ; File: MTHCDSINC.MAR Edit: RNH1002
0000
0000    ;
0000    ;****************************************************************************
0000    ;*                                                                          *
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0000    ;*  SOFTWARE ON EQUIPMENT WHICH IS NOT SUPPLIED BY DIGITAL.                 *
0000    ;*                                                                          *
0000    ;*                                                                          *
0000    ;****************************************************************************
0000    ;
0000    ;
0000    ;
0000    ; FACILITY: MATH LIBRARY
0000    ;++
0000    ; ABSTRACT:
0000    ;       Return the SINE of a D COMPLEX*16 number
0000    ;       Return the COSINE of a D COMPLEX*16 number
0000    ;
0000    ;
0000    ;--
0000    ;
0000    ; VERSION: 1
0000    ;
0000    ; HISTORY:
0000    ;
0000    ; AUTHOR:
0000    ;       Steven B. Lionel, 26-July-1979
0000    ;
0000    ; MODIFIED BY:
0000    ;
0000    ;
0000    ;
```

```
0000            .SBTTL  HISTORY         ; Detailed Current Edit History
0000
0000
0000    ; Edit History
0000    ;
0000    ; 1-001 - Adapted from MTH$CSINCOS version 1-002.  SBL 26-July-1979
0000    ; 1-002 - Changed shared external references to G^ RNH 25-Sep-81
```

```
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                0000    59              .SBTTL  DECLARATIONS
                0000    60
                0000    61 ;
                0000    62 ; INCLUDE FILES:
                0000    63 ;
                0000    64
                0000    65 ;
                0000    66 ; EXTERNAL SYMBOLS:
                0000    67              .DSABL  GBL
                0000    68              .EXTRN  MTH$DSIN_R7
                0000    69              .EXTRN  MTH$DCOS_R7
                0000    70              .EXTRN  MTH$DEXP_R7
                0000    71
                0000    72 ;
                0000    73 ; MACROS:
                0000    74 ;
                0000    75
                0000    76 ;
                0000    77 ; PSECT DECLARATIONS:
            00000000    78              .PSECT  _MTH$CODE       PIC, SHR, LONG, EXE, NOWRT
                0000    79
                0000    80 ;
                0000    81 ; EQUATED SYMBOLS:
                0000    82
                0000    83 ;
                0000    84 ; OWN STORAGE:
                0000    85 ;            NONE
```

```
                       0000          .SBTTL  MTH$CDSIN - D COMPLEX*16 SINE
                       0000
                       0000   ;++
                       0000   ; FUNCTIONAL DESCRIPTION:
                       0000   ;
                       0000   ;       MTH$CDSIN computes the SINE of a D COMPLEX*16 number (r, i) as
                       0000   ;
                       0000   ;       result = (SIN(r) * COSH(i), COS(r) * SINH(i))
                       0000   ;
                       0000   ; CALLING SEQUENCE:
                       0000   ;       CALL MTH$CDSIN (result.wdc.r, arg.rdc.r)
                       0000   ;
                       0000   ;
                       0000   ; INPUT PARAMETERS:
            00000008   0000           arg     = 8             ; D COMPLEX*16 argument by reference
                       0000   ;
                       0000   ; IMPLICIT INPUTS:
                       0000   ;       NONE
                       0000   ;
                       0000   ; OUTPUT PARAMETERS:
                       0000   ;
            00000004   0000           result  = 4             ; D COMPLEX*16 result by reference
                       0000   ;
                       0000   ; IMPLICIT OUTPUTS:
                       0000   ;       NONE
                       0000   ;
                       0000   ; COMPLETION CODES:
                       0000   ;       NONE
                       0000   ;
                       0000   ; SIDE EFFECTS:
                       0000   ;       Signals:        Reserved Operand if r or i are invalid (-0.0)
                       0000   ;                       MTH$_SINSIGLOS if |r| > 2*PI*2**31.
                       0000   ;                       Floating Overflow if i > 88.028.
                       0000   ;
                       0000   ;--
                       0000
                       0000
                0OFC   0000          .ENTRY  MTH$CDSIN,      ^M<R2,R3,R4,R5,R6,R7>
     00000039'EF  16   0002          JSB     WORKER                  ; R0-R1 = SIN(r)
                       0008                                          ; R2-R3 = COS(r)
                       0008                                          ; R4-R5 = SINH(i)
                       0008                                          ; R6-R7 = COSH(i)
          50  56  64   0008          MULD2   R6, R0                  ; R0-R1 = SIN(r) * COSH(i)
          52  54  64   000B          MULD2   R4, R2                  ; R2-R3 = COS(r) * SINH(i)
       54   04 AC D0   000E          MOVL    result(AP), R4          ; get result address
          84  50  7D   0012          MOVQ    R0, (R4)+               ; Store real part
          64  52  7D   0015          MOVQ    R2, (R4)                ; Store imaginary part
                  04   0018          RET
```

```
                         0019   136           .SBTTL  MTH$CDCOS - D COMPLEX*16 Cosine
                         0019   137
                         0019   138 ;++
                         0019   139 ; FUNCTIONAL DESCRIPTION:
                         0019   140 ;
                         0019   141 ;         MTH$CDCOS computes the COSINE of D COMPLEX*16 number (r, i) as follows:
                         0019   142 ;
                         0019   143 ;         result = (COS(r) * COSH(i), -SIN(r) * SINH(-i))
                         0019   144 ;
                         0019   145 ; CALLING SEQUENCE:
                         0019   146 ;         CALL MTH$CDCOS (result.wdc.r, arg.rdc.r)
                         0019   147 ;
                         0019   148 ;
                         0019   149 ; INPUT PARAMETERS:
               00000008  0019   150           arg     = 8                ; D COMPLEX*16 argument by reference
                         0019   151 ;
                         0019   152 ; IMPLICIT INPUTS:
                         0019   153           NONE
                         0019   154 ;
                         0019   155 ; OUTPUT PARAMETERS:
                         0019   156 ;
               00000004  0019   157           result  = 4                ; D COMPLEX*16 result by reference
                         0019   158 ;
                         0019   159 ; IMPLICIT OUTPUTS:
                         0019   160           NONE
                         0019   161 ;
                         0019   162 ; COMPLETION CODES:
                         0019   163           NONE
                         0019   164 ;
                         0019   165 ; SIDE EFFECTS:
                         0019   166 ;         Signals:          Reserved Operand if r or i are invalid (-0.0)
                         0019   167 ;                           MTH$_SINSIGLOS if |r| > 2*PI*2**31.
                         0019   168 ;                           Floating Overflow if i > 88.028.
                         0019   169 ;
                         0019   170 ;--
                         0019   171
                         0019   172
                   00FC  0019   173           .ENTRY  MTH$CDCOS,      ^M<R2,R3,R4,R5,R6,R7>
         00000039'EF  16  001B  174           JSB     WORKER                  ; R0-R1 = SIN(r)
                          0021  175                                           ; R2-R3 = COS(r)
                          0021  176                                           ; R4-R5 = SINH(i)
                          0021  177                                           ; R6-R7 = COSH(i)
            56   52   64  0021  178           MULD2   R2, R6                  ; R6-R7 = COS(r) * COSH(i)
            50   50   72  0024  179           MNEGD   R0, R0                  ; R0-R1 = -SIN(r)
       52   54   50   65  0027  180           MULD3   R0, R4, R2              ; R2-R3 = -SIN(r) * SINH(i)
            50   56   7D  002B  181           MOVQ    R6, R0                  ; R0-R1 = COS(r) * COSH(i)
       54     04 AC   D0  002E  182           MOVL    result(AP), R4          ; get result address
            84   50   7D  0032  183           MOVQ    R0, (R4)+               ; Store real part
            64   52   7D  0035  184           MOVQ    R2, (R4)                ; Store imaginary part
                      04  0038  185           RET
```

```
                              0039                .SBTTL  WORKER - do all the work
                              0039
                              0039       ;+
                              0039       ; Setup error handler
                              0039       ; Compute:
                              0039       ;               R0-R1 = SIN(r)
                              0039       ;               R2-R3 = COS(r)
                              0039       ;               R4-R5 = SINH(i)
                              0039       ;               R6-R7 = COSH(i)
                              0039       ;-
                              0039
                              0039       WORKER:
                              0039                MTH$FLAG_JACKET                   ; set up error handler
                              0039
     6D   00000000'GF     9E  0039                MOVAB   G^MTH$$JACKET_HND, (FP)
                              0040                                                  ; set handler address to jacket
                              0040                                                  ; handler
                              0040
          50    08 AC     D0  0040                MOVL    arg(AP), R0               ; R0 -> (r, i)
          50    08 A0     70  0044                MOVD    8(R0), R0                 ; R0-R1 = i
          00000000'GF     16  0048                JSB     G^MTH$DEXP_R7             ; R0-R1 = EXP(i)
        52    08    50    67  004E                DIVD3   R0, #1, R2                ; R2-R3 = EXP(-i)
                              0052
        54    50    52    63  0052                SUBD3   R2, R0, R4                ; R4-R5 = EXP(i) - EXP(-i)
        7E    54    00    65  0056                MULD3   #0.5, R4, -(SP)           ; (SP) = SINH(i)
                              005A
        54    50    52    61  005A                ADDD3   R2, R0, R4                ; R4-R5 = EXP(i) + EXP(-i)
        7E    54    00    65  005E                MULD3   #0.5, R4, -(SP)           ; (SP) = COSH(i)
                              0062
          50    08 BC     70  0062                MOVD    @arg(AP), R0              ; R0-R1 = r
          00000000'GF     16  0066                JSB     G^MTH$DCOS_R7             ; R0-R1 = COS(r)
                7E  50    7D  006C                MOVQ    R0, -(SP)                 ; (SP) = COS(r)
                              006F
          50    08 BC     7D  006F                MOVQ    @arg(AP), R0              ; R0-R1 = r
          00000000'GF     16  0073                JSB     G^MTH$DSIN_R7             ; R0-R1 = SIN(r)
                52  8E    7D  0079                MOVQ    (SP)+, R2                 ; R2-R3 = COS(r)
                56  8E    7D  007C                MOVQ    (SP)+, R6                 ; R6-R7 = COSH(i)
                54  8E    7D  007F                MOVQ    (SP)+, R4                 ; R4-R5 = SINH(i)
                              0082
                          05  0082                RSB
                              0083
                              0083
                              0083
                              0083                .END
```

```
ARG             = 00000008
MTH$$JACKET_HND   ********    X   01
MTH$CDCOS         00000019 RG     01
MTH$CDSIN         00000000 RG     01
MTH$DCOS_R7       ********    X   00
MTH$DEXP_R7       ********    X   00
MTH$DSIN_R7       ********    X   00
RESULT          = 00000004
WORKER            00000039 R      01

                                                 +----------------+
                                                 ! Psect synopsis !
                                                 +----------------+

PSECT name                      Allocation          PSECT No.  Attributes
----------                      ----------          ---------  ----------
.  ABS  .                       00000000  (     0.)  00 (   0.)  NOPIC   USR   CON   ABS   LCL NOSHR NOEXE NORD  NOWRT NOVEC BYTE
_MTH$CODE                       00000083  (   131.)  01 (   1.)    PIC   USR   CON   REL   LCL   SHR   EXE   RD  NOWRT NOVEC LONG

                                              +------------------------+
                                              ! Performance indicators !
                                              +------------------------+

Phase                       Page faults     CPU Time        Elapsed Time
-----                       -----------     --------        ------------
Initialization                       33     00:00:00.09     00:00:01.26
Command processing                  111     00:00:00.63     00:00:03.38
Pass 1                               89     00:00:00.73     00:00:02.56
Symbol table sort                     0     00:00:00.01     00:00:00.01
Pass 2                               54     00:00:00.61     00:00:03.07
Symbol table output                   2     00:00:00.03     00:00:00.25
Psect synopsis output                 2     00:00:00.02     00:00:00.08
Cross-reference output                0     00:00:00.00     00:00:00.00
Assembler run totals                293     00:00:02.14     00:00:10.62

The working set limit was 900 pages.
3610 bytes (8 pages) of virtual memory were used to buffer the intermediate code.
There were 10 pages of symbol table space allocated to hold 9 non-local and 0 local symbols.
285 source lines were read in Pass 1, producing 14 object records in Pass 2.
1 page of virtual memory was used to define 1 macro.

                                             +--------------------------+
                                             ! Macro library statistics !
                                             +--------------------------+

Macro library name                           Macros defined
------------------                           --------------
_$255$DUA28:[SYSLIB]STARLET.MLB;2                  0

0 GETS were required to define 0 macros.

There were no errors, warnings or information messages.

MACRO/ENABLE=SUPPRESSION/DISABLE=(GLOBAL,TRACEBACK)/LIS=LIS$:MTHCDSINC/OBJ=OBJ$:MTHCDSINC MSRC$:MTHJACKET/UPDATE=(ENH$:MTHJACKET)+MS
```

0258 AH-BT13A-SE
VAX/VMS V4.0

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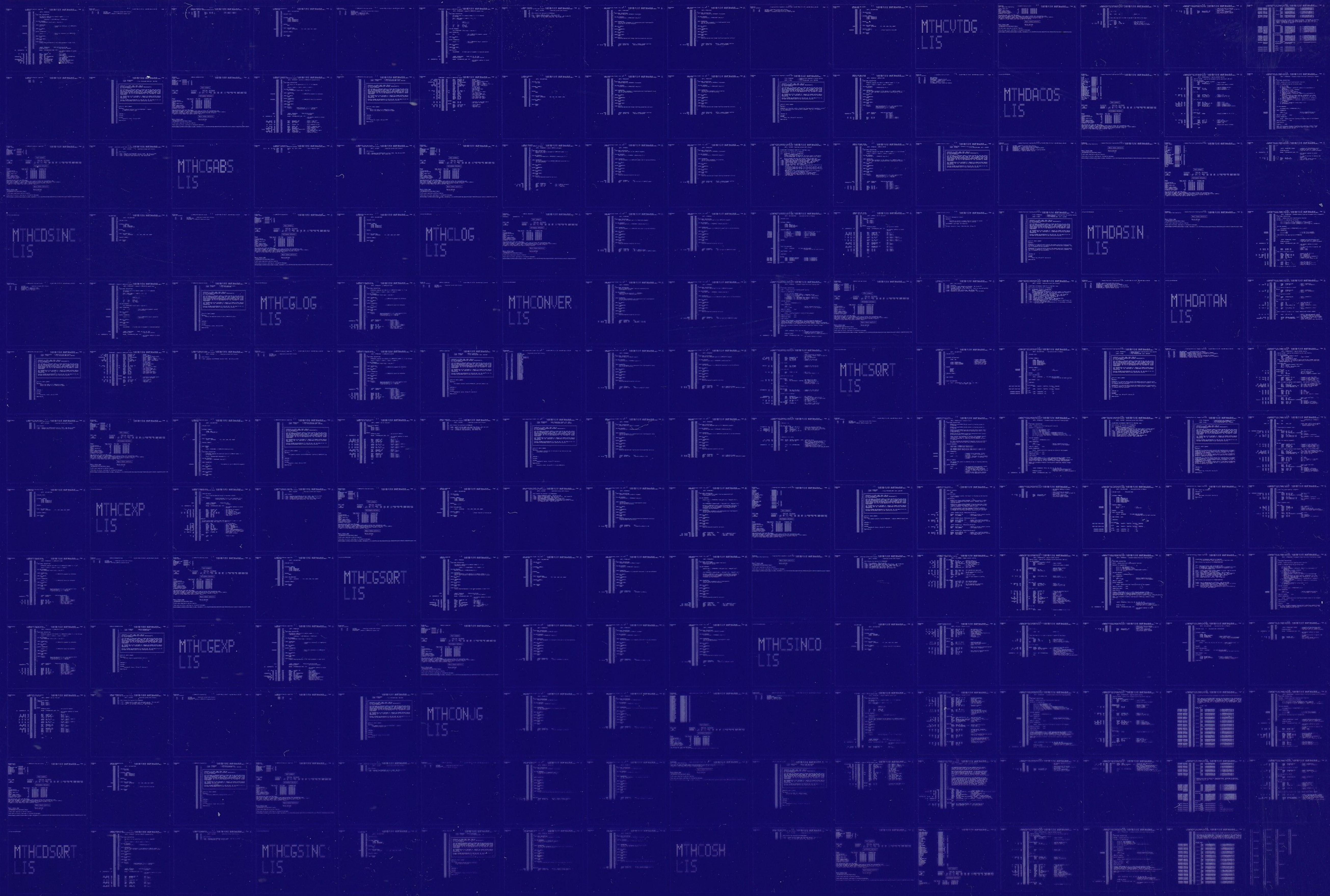

MTHCVTDG
LIS

MTHDACOS
LIS

MTHCGABS
LIS

MTHCDSINC
LIS

MTHCLOG
LIS

MTHDASIN
LIS

MTHCGLOG
LIS

MTHCONVER
LIS

MTHDATAN
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MTHCSQRT
LIS

MTHCEXP
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MTHCGSQRT
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MTHCGEXP
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MTHCSINCO
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MTHCONJG
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MTHCGSINC
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